

Siro KURITA & Hiroshi TOBE*: **Studies on
Cimicifuga japonica (Thunb.) Sprengel**

(1) Aberration in meiosis**

栗田子郎・戸部 博*:イヌシヨウマの研究

(1) 減数分裂の異常性について**

Although *Cimicifuga japonica* is distributed in a limited area of Japan, Central Honshu, its gross morphology shows a wider range of variation (cf. Hara 1943), in which our principle interest of this study lies. In *Cimicifuga*, some data on the somatic chromosomes have been accumulated so far (Langlet 1927, 1932; Nakajima 1933; Gregory 1941; M. Kurita 1956; etc.). However, there is very meager study on the gametic chromosomes. Sugiura (1937, 1939) reported $n=8$ in *C. acerina* var. *obtusiloba* but nothing of the microsporogenesis. In this paper, some noticeable features in meiosis of *C. japonica* will be described, with special reference to aberrant behaviour of chromosomes in the karyokinesis.

Materials and methods Materials used for the present study were collected at Takagoyama hill, Chiba Prefecture, and they were potted at our experimental garden of Chiba University. For the observation of microsporogenesis, young flower buds were fixed in a mixture of one part of glacial acetic acid and three parts of 99% ethyl alcohol for about 24 hours or longer. The anthers thus fixed were squashed after addition of 1% aceto-carmin.

Observation and discussion Throughout our investigation, 8 bivalent chromosomes were counted in most pollen mother cells, but the pairing behaviour of each bivalent was different in each mother cell (Fig. 1a-c). In addition, a few pollen mother cells showed considerable irregularity of pairing behavior in the meiosis. Figure 2a represents a mother cell at the first meiotic metaphase which has eight bivalents and one fragment (8II+1frag.). Similarly, figures 2b, c, and d show 6II+1IV, 6II+1III+1frag.,

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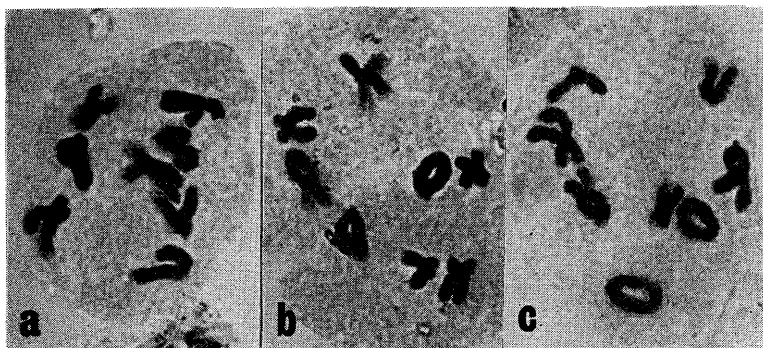


Fig. 1a-c. Three pollen mother cells at the first meiotic metaphase ($n=8$), showing a little different patterns of chiasma formation $\times ca. 1100$.

and 6II+1 chromosome clump respectively.

In the anaphase and interphase, furthermore, it was observed that the chromosome bridges or strings (Fig. 3a), lagging chromosomes and micronuclei between two daughter nuclei (Fig. 2b) frequently occurred, and similar features were also observed in the second meiotic division. These mother cells, therefore, show polycaric condition at the end of sporogenesis and they form microspore pentad or hexad (Fig. 3c, d). The occurrence of such aberrant pollen mother cells is as frequent as nearly 3% to 7% in each pollen sac.

Until present, there has been no study on the microsporogenesis of this species. Muerman and Therman (1939), however, reported the meiotic division of the genus *Clematis*, which also belongs to the family Ranunculaceae. They also observed the chromosome bridges and micronuclei formation at the first meiotic anaphase, and they concluded that aberrant meiosis is caused by structural hybridity. Existence of uni- and multivalent chromosomes at the first metaphase and the formation of chromosome bridges at the first and second anaphase in *Cimicifuga japonica* may also be ascribable to the structural hybridity as suggested in *Clematis*.

On the other hand, it may be noteworthy that some of the flower buds of an inflorescence of this species are deposited by small parasites (a species of the Cynididae or the Chalcidoidea) at very young stages. In these flowers, according to a study of the present writers (unpublished), the pollen mother cells usually do not develop, but in very rare cases a

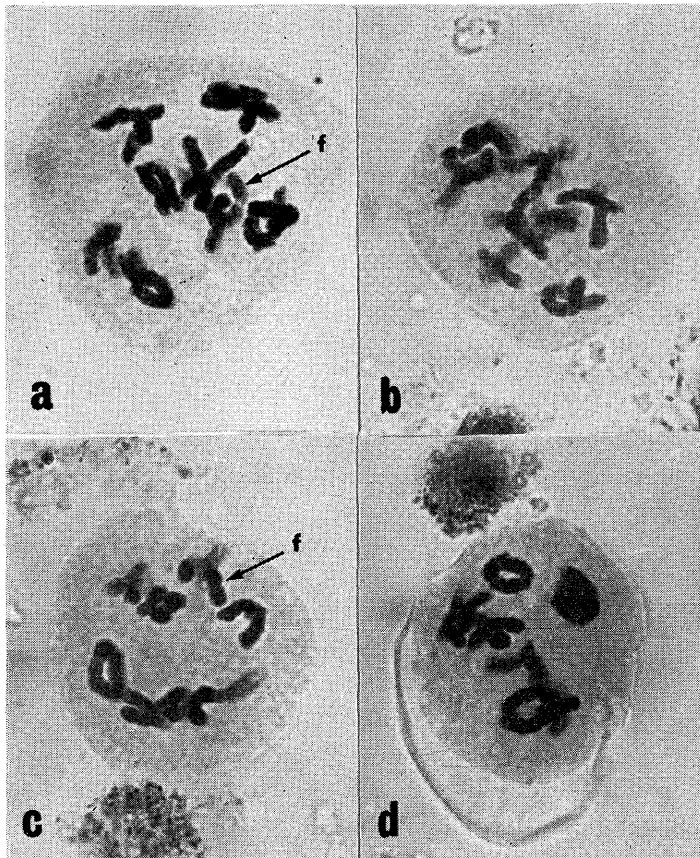


Fig. 2a-d. Irregular pairing of chromosomes at the first meiotic metaphase. f: fragment. \times ca. 1100.

few pollen mother cells differentiate and perform meiotic division. These pollen mother cells usually show irregular meiotic division, resulting in polycaric and polysporic conditions at the end of sporogenesis. Although irregular meiosis is usually found at lower percentages in flowers having no parasites, it may or may not be also caused by certain chemical substances produced and transported from gall-flowers.

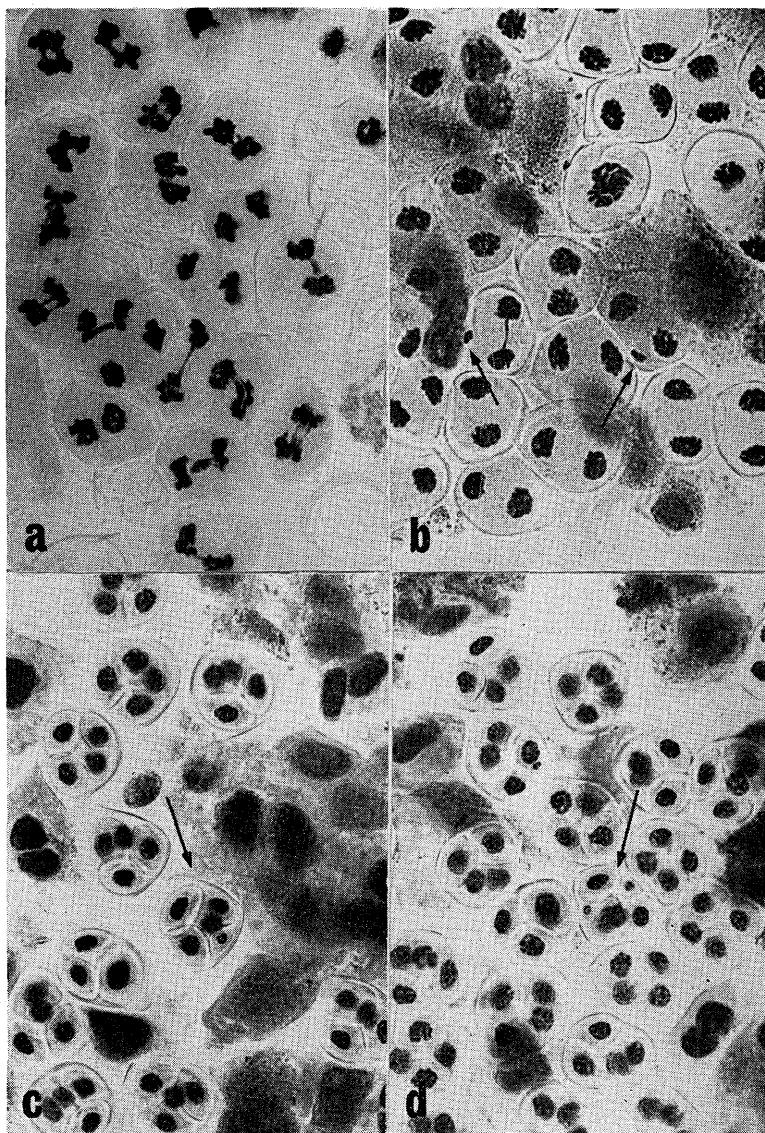


Fig. 3a-d. a: Showing chromosome bridges or strings observed at the first meiotic division. \times ca. 450. b: Telophase of the first division. Arrows show the micronuclei. \times ca. 450. c: The final stage of meiosis. Arrows show microspore pentad. \times ca. 450. d: The final stage of meiosis. Arrow shows microspore hexad. \times ca. 450.

Summary

- 1) The haploid chromosome number of *Cimicifuga japonica* is $n=8$.
- 2) The aberrant meiotic division is observed at the rate of nearly 3% to 7%.
- 3) The occurrence of uni- and multivalent chromosomes and the formation of chromosome bridges may suggest the presence of structural hybridity in this species.
- 4) Such possibility was also discussed that irregular meiosis in the flowers which have no parasites may be under the influence of certain chemical substances from the gall-flowers.

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References

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イヌシヨウマの体細胞染色体については、すでに Langlet (1927, 1932) や Kurita (1956) などの報告があり、 $2n=16$ であることが知られているが、減数分裂についての研究はなかった。筆者等は今回の観察で、 $n=8$ であることを確認したが、第一分裂の前中期での対合のしかたは細胞ごとに多少の変化があり、一つの花粉のうにつき約 3% ないし 7% の頻度で一価染色体、多価染色体あるいは染色団塊などが形成される。さらに第一および第二分裂の後期には染色体橋や遅退染色体がみられ、分裂完了後には正常な 4 分子のほかに 5 分子や 6 分子などが形成される。

このような異常性は *Clematis* の減数分裂を研究した Meurman and Therman (1939) が述べたように構造雑種性に起因するものと考えられる。しかし筆者等 (未発表) はイヌシヨウマの虫えい花において高頻度でおこる異常な花粉形成過程をみているので、非宿主の正常な花にみられる分裂の混乱が虫えい花で形成されるなんらかの化学物質に起因する可能性も考えられる。